

(REVIEW ARTICLE)



The interconnection between vitamin B₁₂ and Alzheimer prevention: A short review

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Abstract

Alzheimer disease is one of the commonest diseases that occurs in the empty shell period. It is a form of dementia which generally occurs in individuals who are mostly above sixty years. It is a common neurodegenerative disease which is characterized by short term memory loss. The prevalence of Alzheimer disease in old aged people now reaching at its peak point. There is no proper treatment for this specific neurodegenerative disease but proper diet can reduce the severity of this disease. So, the main objective of the study is to combat the severity of Alzheimer disease by the use of diet that is rich in vitamin B₁₂. This specific vitamin is especially effective towards the reduction of beta amyloid protein by reducing the amount of reactive oxygen species.

Keywords: Alzheimer; Dementia; Neurodegenerative; Beta-amyloid protein; Reactive oxygen species.

1. Introduction

Alzheimer disease is an early onset of dementia that affects the cognitive functions of the human being [1]. The disease is mostly occurring in the geriatric group people above 60 years of age. The prevalence of Alzheimer is mostly common in women than in man.

Alzheimer is severe than any other forms of dementia because in Alzheimer the patients are prone to short term memory loss and start to remember something which never has been occurred [2]. So, in Alzheimer disease both the short-term memory loss and eventually the episodic memory loss occur simultaneously. The effects of Alzheimer are not only affecting the cognitive domain but also affects the interconnected emotional domain and psychomotor domains as well.

2. Occurrence of Dementia

We know dementia is a broad term and Alzheimer is one of the forms of dementia. From the recent report from WHO (World health Organization), it is concluded that Dementia is mostly prevalent in under developed and developing countries (popularly known as Growth without development countries). Now coming to the statistics part of dementia, about 55 million people are suffering from dementia worldwide and the number is increasing year to year [3].

According to the report of GBD (Global Burden of Disease)2016, a total of 3.74 million people of South Asia have dementia out of which 2.93 million coming solely from India [4].

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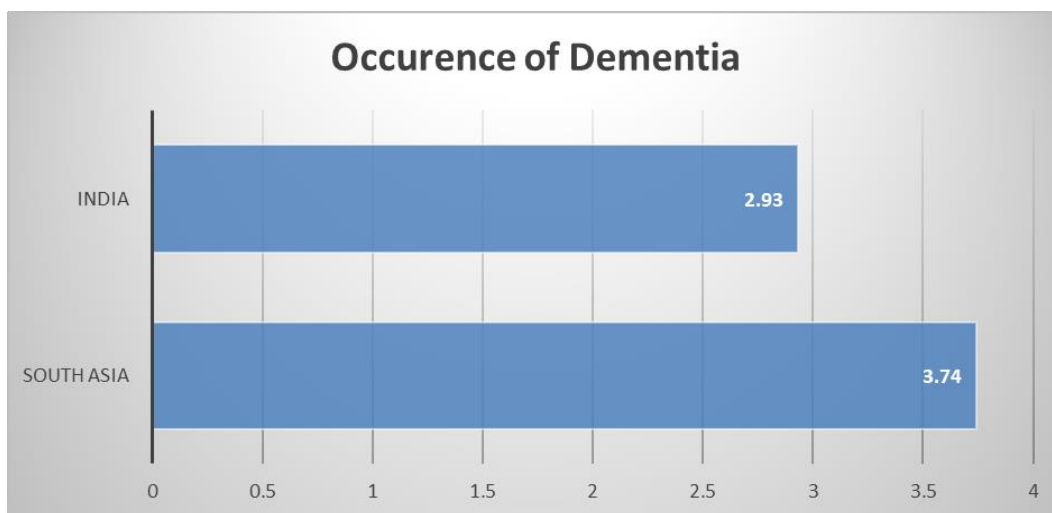


Figure 1 The graphical representation of the occurrence of dementia according to GBD report (2016)

2.1. The established relation between Alzheimer disease and hippocampus

Central nervous system and peripheral nervous system are the components of nervous system. The central nervous system is composed of brain and spinal cord, the other part peripheral nervous system is composed of cranial and spinal nerves. The brain in the central nervous system is the main part where the Alzheimer disease occurs.

The occurrence of this disease is in the hippocampus of the brain. Hippocampus is one of the main regions for learning and memory process[5]. Hippocampus is generally affected by many neurodegenerative disorders but it is mostly affected by Alzheimer disease. At the beginning of this disease the tissues in the hippocampus are severely affected and damaged. That is why the functionality of the brain is affected [6].

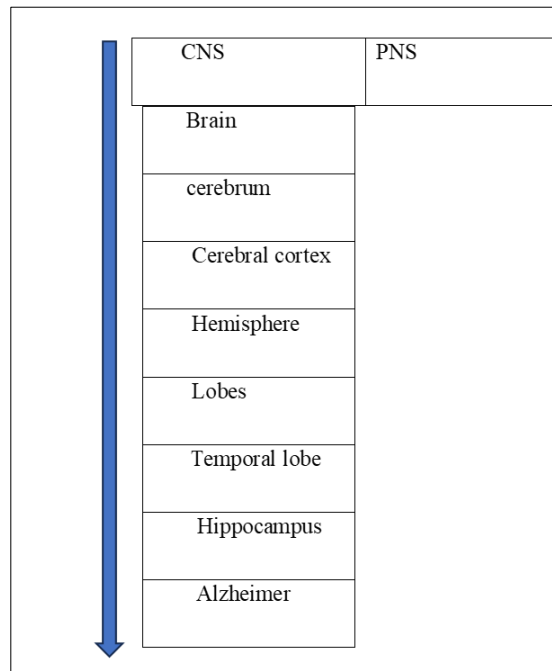


Figure 2 Occurrence of Alzheimer in the nervous system

The brain has three main parts cerebrum, cerebellum and brain stem. The largest part cerebrum has two main components white matter and gray matter or cerebral cortex. The cerebral cortex itself has two parts or hemispheres. The hemisphere has subsequent sections or lobes. The lobes are frontal lobe, parietal lobe, occipital lobe and temporal lobe as well[7]. The hippocampus is placed in the temporal lobe which is situated above of the ear[5].

2.2. Formation of beta amyloid protein

The beta amyloid protein is supposed to be the main cause of Alzheimer disease. Beta amyloid protein is a 4 kilodalton fragment that is produced from Amyloid precursor protein [8]. Brain neurons continuously produce Amyloid precursor protein (APP) and beta amyloid protein is produced when the APP is cleaved by two proteolytic enzymes beta secretase and gamma secretase [9].

| |
|---|
| Formation of amyloid precursor protein. |
| APP cleaved by enzymes. |
| Formation of beta amyloid protein and affect the brain. |

Figure 3 Formation of Beta amyloid protein

2.3. The effectiveness of vitamin B 12 in Alzheimer disease

There is a close relationship between beta amyloid and ROS. Whenever there is an increase in ROS there is an increase in beta amyloid protein because ROS can contribute oxidative damage bound to beta amyloid protein [10].

There is a direct interlinking relation between vitamin B12 and beta amyloid protein. Vitamin B12 is an organic substance that can't be synthesized by the body popularly known as water soluble vitamin. Every vitamin is an efficient source of antioxidant. Vitamin B12 is a water-soluble vitamin and the precising property to reduce the effectiveness of beta amyloid protein makes this vitamin a little differentiator than other vitamins in perspective of Alzheimer disease prevention.

2.4. The ability to cross the BBB

The central nervous system and peripheral nervous system are separated from each other by BBB (Blood Brain Barrier) that prevents the circulation of toxic products in the brain. Vitamin B12 is available in different forms like Methylcobalamin, Cyanocobalamin. Out of them Methylcobalamin is the only form that can cross the blood brain barrier and shows its antioxidant activity against ROS [11].

2.5. Effectivity against oxidative products

Vitamin B12 is said to be effective to reduce the tumor necrosis factor which is a major cause of Alzheimer disease. Tumor necrosis factor (alpha) is situated on chromosome 6. Tumor necrosis factor (alpha) has two receptors out of which TNFR1 (receptor 1) contains a death domain in its cytoplasmic proteins and cause a homotypic interaction between death receptors and cytoplasmic proteins. Thus, TNFR1 causes apoptosis or cell death. [12]

2.6. Ability to reduce homocysteine level

High homocysteine level increases the production of reactive oxygen species by reducing the production of different antioxidant enzymes like superoxide dismutase and glutathione peroxidase which in return increases the level of hydrogen peroxide. The hydroxyl radical can cause oxidative damage on the beta amyloid protein [13]. Vitamin B12 is effective to convert homocysteine to methionine by serving as a co factor of the enzyme methionine synthase, thus reducing the production of homocysteine which can increase the level of beta amyloid protein [13].

2.7. Incorporation of vitamin B 12 in the diet

We can incorporate vitamin B12 daily through the diet and supplementation. Including different foods like red meat, salmon, clams, cows' milk in the diet can increase the level of vitamin B 12. Keeping aside the non- vegetarian options, we can also get vitamin B 12 from fortified cereals, soya milk where the nutrient content of the food is improved through biofortification. Some fermented foods can also provide vitamin B12 like tempeh, nori etc. There is another option to include vitamin B 12 that is in the medical form like nutraceuticals forms and now a days we can incorporate any nutrient through the process of nano technology like seed priming etc.

3. Conclusion

Through the detailed review we can conclude that Vitamin B 12 is beneficial to Alzheimer disease in perspectives of prevention. So, Vitamin B12 rich diet should be taken in regular basis from childhood till the senescence period. We all know that there is no proper medicine that can fully cure the Alzheimer but through the consumption of proper diet like vitamin B 12, we can prevent the early onset of Alzheimer. Although consultation with any healthcare professional is important before adding any supplementation to your dietary habits.

Compliance with ethical standards

Disclosure of conflict of interest

There is no conflict of interest to be disclosed.

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